

CARRYING CAPACITY OF PASTURES

IN MUSKOGEE COUNTY

OKLAHOMA

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By

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Chapter I

INTRODUCTION

With most stockmen, particularly those possessing larger herds, there is always felt a need for new ideas in better and more profitable pastures. There is a constant need for information that will lend itself to the solving of the problem of pastures producing the greatest gain at a minimum cost to the owner. Most stockmen have interests, desires, and possibly certain obligations different from the average landowner or leaser.

Origin and Growth of the Problem. The writer has been associated with the landowners and leasers of Muskogee County and their boys and girls for three years, and previous to this time the same association with a somewhat similar group in Cherokee County. Through this association an interest was stimulated which caused him to make this study on the carrying capacity of the pastures in Muskogee County and methods in improvement. In order to make a complete survey of this subject, it was necessary to obtain answers to many questions.

The Problem Stated. The main objective of this study was to get accurate facts of the pastures of Muskogee County and to find their carrying capacity under present conditions, then recommend changes for their improvement. It is hoped that this information will be helpful to those interested stockmen of the same and similar areas, in providing better and more grazing per acre at a

greater net income. It will be assumed that stockmen will arrange their pastures and cattle so they will derive the greatest benefits for themselves and their posterity.

Delimitations. This subject was based on pasture lands of Muskogee County, dealing particularly with the carrying capacity of several pastures during the past year. This subject could be made broader by including all the pastures of Muskogee County and other counties of the state, and other areas in grazing belts. An historical study could be made of these pastures. The subject is unlimited without confining it to a definite area as has been done by the writer.

Definitions of Terms. In this study certain terms are used quite often in such a way that definitions of them might prove helpful. The definitions given here represent the conceptions of the writer.

The word pasture refers to an area inhabited with grasses or other plants palatable to cattle.

Cultivated pastures are those having seed beds prepared by means of physical labor.

Native pastures are uncultivated pastures.

Stockmen as used here refers to those owning and grazing livestock, particularly cattle.

The word bulletin refers to any publication pertaining to pastures, usually published by the United States Department of Agriculture or some Agricultural Experiment Station.

Carrying capacity is the number of acres required to support one cow unit without permanent injury to the forage crop.

Cow unit as used in this study is equivalent to the grazing of one cow or horse, four calves or colts, or seven sheep.^{1/}

Deferred grazing is grazing by changing livestock from one area to another in such a manner that seeds will mature for reseeding.

Continued grazing is keeping livestock on the same pasture without change.

Supplemental pasturing refers to feeding some forage while grazing.

Pests are those plants or animals that decrease pasture plant growth or injure animals or their by-products.

Similar Studies. In making this study, an effort was made to determine whether or not anyone else had conducted an investigation of this nature. Neither the United States Department of Agriculture nor the Oklahoma Agricultural and Mechanical College knew of any such study in Oklahoma. Some material that helped in pursuing this study of pastures was found in bulletins reporting of related studies of grazing lands. The persons who were interviewed contributed many helpful statements, which will be found in the chapter containing conclusions and recommendations.

^{1/} G. F. Warren, Farm Management, pp. 210-11.

Uses of Results of This Study In order to bring the stockmen together with an organized effort to change the carrying capacity of their pastures, we must face the fact that the government is gradually changing its policies toward the stockmen who are supplying the greater per cent of the nation's meat supply. This study will be helpful to the boys and girls who are to undertake production of cattle and the present stockmen who are endeavoring to make efficient changes in pasture lands.

In making this study it was felt desirable to furnish more of a background by supplying some general information on Muskogee County. This will enable the reader better to apply the findings of this study to similar conditions.

Chapter II

MUSKOGEE COUNTY

Before continuing, it might be well to state some factors which make this study more meaningful, in particular, information on geographic location, topography, population, climatic conditions, vegetation, and pastures of pioneer days.

Much of the information for this chapter was obtained by the writer's personal observations and his interviews of older residents of the county, while the remaining facts were obtained from bulletins and books prepared by people connected with affairs of the county.

Geographic Location. Muskogee County, the area of which is 826 square miles, is in northeast Oklahoma with its east and west boundaries $95^{\circ}3'$ W. and $95^{\circ}43'$ W. longitude, respectively.^{2/} Its irregular shape accounts for its small area, ranging from $35^{\circ}30'$ N. on the south to $35^{\circ}52'$ N. on the north. The greater part of the county's boundary is artificial; however about one-half of the north boundary and a small portion of the east boundary is the Arkansas River. The Canadian River separates Haskell County from Muskogee County on the extreme south.

Topography. A small area of the northeast part of Muskogee County is in the Ozark Mountain region; the western part extends into the plains region, and the

^{2/} E. K. Gaylord, Oklahoma Almanac, 1931, p. 87.

southeastern portion lies in the Arkansas Valley region. The elevation varies from less than 500 feet to more than 1000 feet above sea level.^{3/} The surface in the major portion is rough with fewer hills in the northwest. The soils of Muskogee County vary, but more than one-half of its area is of the Gerald Series with the following types: loam, silt loam, fine sandy loam and very fine sandy loam.^{4/} Much of the elevated area is underlain by shale and sandstone which are near the surface.

There is not sufficient slope in the river basin to permit the run off without water standing over lowlands which are made less fertile by such treatment. Desirable water is available from wells ranging 20 feet to 60 feet in depth. Some water is supplied by springs which have their sources in limestone regions.

Climate. Muskogee County's mean temperature is 60.5°F. for the past 41 years. The highest annual mean temperature of 64.1° was in 1921 which was only .1° above the 1938 record. The low temperature during January and February of 1936 prevented an all time record from the exceedingly hot and dry days of June, July, and August. The summer days are usually hot followed by cool nights with a breeze.

The mean annual precipitation for Muskogee since the weather station was established is about 40 inches of which

^{3/} C. H. Fitch, Topographic Map, 1929,

^{4/} Grove B. Jones, Soil Survey of Muskogee County, 1915.

about 75 per cent comes during growing season.^{5/} There have been two years with annual precipitation of less than 30 inches, 1914 and 1936 with 27.97 and 19.28 inches respectively. The small amount of precipitation during the winter months of 1939-40 resulted in an insufficient supply of water in the subsoil for proper plant functioning.

There are very few days of sub-zero weather during the year or days with maximum temperature above 100°F.; however there have been exceptions, as 1930 and 1939 for cold weather and 1934 and 1936 outranking in hot summers.

The frost-free season usually lasts about six months. The growing season for many plants is about eight months. Very few, if any, perennials are completely destroyed by cold winters, but the long dry summer season has almost excluded some perennials.

Vegetation. Muskogee County is blessed with a vast covering of vegetative growth of both useful and harmful plants. Its different altitudes and kinds of soils makes it adaptable for many plants. It is in the transition zone between the eastern deciduous forest represented mainly by the Oak-Hickory forest, and the grassland represented by the tall grasses on the western side. There is an interweaving of vegetation which makes it suitable for grazing land. Most grasses, of which there are 73 genera and 232 species in Oklahoma, require adequate

^{5/} H. F. Wahlgren, Climatological Data, U.S.D.A. Weather Bureau Vol. 38-47.

moisture and sunlight which occur in Muskogee County at most times.^{6/} In this warm climate with proper care many of these species could be grown economically, some becoming dominant when in competition with others.

The long growing season and moderate winters are conducive to plants establishing a good root system, getting proper branch growth, and maturing a sufficient supply of seeds to aid them in their struggle with other plants and animals.

Population. The 1940 census showed a population of 65,914, or a density of approximately 80 persons per square mile, which was eight-tenths of one per cent decrease from the 1930 population.

Less than 45 per cent of the total population live on 3069 farms which are the chief source of food supplies. In 1940, 29,907 cattle over three months of age were being kept on these farms while in 1935, 33,662 cattle of all ages were on 3,805 farms.^{7/}

A present trend in Muskogee County is building new dairies and expanding the old ones. This has increased the dairy animals about 50 percent during the past five years.

Pastures of Pioneer Days. The Muskogee area has been used for grazing many years. One of the old cattle trails,

^{6/} H. I. Featherly, Grasses of Oklahoma, Tech. Bul. 3, 1938.

^{7/} Zellmer R. Pettet, Census of Agri. Okla., 1940.

Shawnee Trail, crossed the county and many drives were made over the trail from Dallas, Texas, to Sedalia, Missouri. Before 1880 the pastures were unfenced and unprotected from grazing as drives were made northward. The extended drives were made during the growing season which made it favorable for grazing herds across the grasslands to get the greatest benefits from them. There are some very interesting accounts of early drives through Muskogee County, among which is George Duffield's Diary which he kept on one of his drives.

In 1883, an act was passed by the United States Senate to tax stock grazing upon Cherokee Lands. Since part of Muskogee County was in the Cherokee Nation the act applied to that land. It then became customary to pay 25 cents per acre annually for grazing privileges.^{8/}

The Curtis Act which was passed in 1898 prohibited cattlemen from fencing any part without leasing, which was to be done through the Indian Commission. Some stockmen would attempt to evade the tax by having herds in the name of a tribal citizen who was exempted from the tax on his cattle.

The native grasses were plentiful until after the Indian allotments began to be sold in the early nineteenth-hundreds. This increased the white population and caused the breaking of the sod for cultivated crops. The decreased grazing area was soon overgrazed and other plants began to

^{8/} A. P. McKellop, Constitution and Laws of Muskogee Nation, 112-21.

appear in pastures. The timber became more noticeable from 1910 to 1915.

"The native pasture which grazed one cow per acre in 1910 grazed one cow per five acres in 1940", says Burke Markham, a 59-year old stockman, who has spent his past life in the cattle industry, following in his father's footsteps. His father settled 3½ miles northeast of Warner, Oklahoma, in 1869. In his pasture it was obvious that the northward slopes retained the native grasses best, especially the Little Blue-stem (Andropogon scoparius) and Big Blue-stem (Andropogon furcatus).

T. F. Hester who was one of the major stockmen in Muskogee County from 1895 to 1924 before retiring to make his home at Warner, Oklahoma, states,

"The greatest weakening of the Blue-stem was during the dry summers with the summer of 1936 almost excluding the Big-Blue-stem from pastures of Muskogee County. Too often have I seen pastures of the twentieth century grazing twice the number of live-stock that it should have been."

Diseases which were carried by ticks began to get into some of the herds by 1900 and continued to increase until from 1904 to 1914 it became compulsory to dip all cattle.^{9/} Some stockmen continued to dip their cattle to prevent the return of the diseases.

The changing of grazing areas was done mostly by driving. In driving, stockmen would spend nights with other stockmen along the way without being charged. They

^{9/} S. F. Nelson, Tick Eradication, pp. 25-39.

would exchange ideas about grazing lands and about the management of their livestock.

Chapter III

METHODS OF SECURING DATA

The data of this study were obtained from inspection of pastures, personal interviews, examination of records, and questionnaires.

The Questionnaire. The questionnaire in this study, with a letter, was mailed to thirty stockmen of Muskogee County who were in different sections of the county. Time would not permit all stockmen to be included in this study, but those used are believed to represent a cross-section of all the stockmen of the county. On pages 14, 15, and 16 will be found copies of the letters and questionnaire that were mailed to the stockmen.

The writer discovered from the replies that many stockmen were unable to correctly answer question 15; therefore it will not be used as intended. It was possible to see some of the stockmen before they filled out the questionnaire. This gave them an opportunity to ask any question they desired.

Of the 30 questionnaires sent 23 were filled out, and in those cases where they were not returned a follow-up letter was sent in an attempt to secure 100 per cent returns. Another valuable method of securing first-hand information was inspection of the pastures.

Personal Inspection of Pastures. The writer, in each case, received permission to enter the stockman's pasture. This revealed the following facts: location of pasture,

kind of soil, flesh of animals, density, condition of pasture plants, and pests. With carrying capacity, an objective, while inspecting pastures the writer made associations of those facts which aid in conclusions and recommendations.

Personal Interviews. The personal interview was used to obtain information that was not included in the questionnaire concerning pastures, livestock, and their management. Interviews were made before or after inspecting the pastures.

Library Materials. Publications consulted in this study were available at Bacone College, Muskogee City, and Oklahoma Agricultural and Mechanical College.

June 12, 1941

Dear Stockman:

Will you please fill out and return at your convenience the following questionnaire? A stamped envelope is enclosed for your convenience.

The information obtained from it is to be used in preparing a paper (Thesis) which might give some useful information to those interested and remaining in the cattle industry.

I thank you very much for your gracious cooperation in filling out this questionnaire.

Sincerely yours,

Z. T. Ferguson

A QUESTIONNAIRE ON CARRYING CAPACITIES OF PASTURES
OF MUSKOGEE COUNTY, OKLAHOMA

1. Name _____ Address _____
2. How long have you been a stockman? _____ years.
3. Was your father a stockman? _____
4. Do you have purebred or grade cattle? _____
5. Classes of livestock on pasture June 1, 1941 (number of head of each.)
dairy cattle _____ beef cattle _____ cattle under 1 yr.
_____Horses _____ colts under 1 yr. _____ goats or sheep _____
6. Kind of pastures: Native _____ acres. Cultivated _____ acres
7. Do you practice deferred grazing, continued grazing, or supplemental pasturing? _____
8. Grasses or other plants most satisfactory for pasture during: spring _____ summer _____
fall _____ winter _____
9. Is salt available at all times? _____
10. Is shelter available during winter months? _____
11. Do you have sufficient shade during summer months? _____
12. Is water obtained from (pond, spring, well, stream, etc?) _____
13. Do you consider your pastures (properly stocked, understocked, or overstocked?) _____
14. Do you have pests in your pasture? _____ List them _____
15. Fill wholly or in part the following:

year	Kind of Pasture	No. of acres grazed	Number of Cattle		No. of Horses		Sheep and Goats
			Under 1 year	Over 1 year	Under 1 year	Over 1 year	
1935							
1936							
1937							
1938							
1939							
1940							

Table Continued

Year	*Causes of Loss	No. of Cattle Lost	**Kind of Water	No. of Months Grazed	Estimated Increase in pounds	
					Beef	Milk
1935						
1936						
1937						
1938						
1939						
1940						

*Causes of loss (disease, poisoned, accident.)

**Kind of water (pond, well, spring, stream, etc.)

Note: Any information given me will be treated strictly confidentially.

516 Duck Street
Stillwater, Oklahoma
June 25, 1941

Mr. George Mueller
Route 3
Muskogee, Oklahoma

Dear Sir:

In continuing my investigation and study of the Carrying Capacity of Pastures of Muskogee County, I find it would be helpful to have your answers to the questionnaire which was sent you June 12.

I would appreciate your cooperation in filling the parts of the questionnaire for which you have available facts. You may feel free to make any additional information concerning your pastures.

Thanking you so much for the past privileges granted me, I am

Sincerely yours,

Z. T. Ferguson

Chapter IV

TABULATION OF DATA

The most essential phases of this study are the tabulation and interpretation of accumulated data. This information is given in tables 1-3 and figures 1-9.

Securing Information. In table 1 the number preceding the name of the stockman will refer hereafter to his pasture. Example: Carl Mayer, pasture 8. They were listed in order of cow units grazed.

Other tabulated information is years of experience as stockman, kind of cattle, grazing of other animals with cattle, and the acreage of each kind of pasture. It was interesting to find that 57 per cent of the stockmen were sons of stockmen. Owner of pasture 22 was a woman, who owned a dairy herd.

Purebred and grade cattle were distinguished in this study. The group represents a cross-section of the common breeds found in Muskogee County. Six stockmen owned both purebred and grade cattle, and one owned only purebred cattle. It is believed that the group of grade and purebred cattle constitutes an average of all breeds in the county.

Seventeen pastures contained horses but usually a small number in each pasture. Pasture 1 had the highest percentage (44 $\frac{4}{9}$ per cent) of horses. Approximately 5 per cent of all grazing animals were horses.

Of the three pastures in which sheep grazed, all were

understocked in the opinion of the stockmen, but the writer classed two as understocked and one as properly stocked. In the three pastures the cattle were thriving. This would not be in accord with the beliefs of some stockmen who are prone to believe cattle will not thrive on a pasture with sheep. On overgrazed areas, the sheep will graze plants closer to the ground than cattle. This makes it more difficult for cattle to get sufficient food.

The native pasture area was approximately 70 per cent greater than that of cultivated pastures. Some native pastures contained escaped cultivated plants. The Big Blue-stem (Andropogon furcatus) has been almost excluded from the native pastures and the Little Blue-stem (Andropogon scoparius) has become very scarce in the majority of the pastures. Dry hot summers decrease these native grasses, but favorable summers aid in restoring the plants where proper grazing is practiced.

All pastures of the twenty-three stockmen replying by questionnaire, were inspected by the writer except pasture 17. Three stockmen were not interviewed. This study has been based on the twenty-three with the omission of the three interviews and the one pasture inspection. Seven were excluded because the writer desired more accurate information before using them. They were sent a follow-up letter but failed to return the questionnaire.

Table II gives the stockmen's choice of plants for different pasture seasons, and the greatest pests from the

stockmen's viewpoint. If a stockman preferred two plants equally, both were included, and if he had no choice a blank was left. The two-year experienced owner of pasture 10 has done no pasturing during winter, but feeds alfalfa hay. It might be interesting to observe that four considered they had no pests and owners of pastures 2 and 18 state that weed pests may be soon destroyed by careful cutting and proper cultivation at the appropriate time.

Some of the stockmen are not familiar with all pasture plants; therefore their selections were limited to those that they recognized. Results of table II will vary as stockmen's opinions change. Stockmen prefer one plant to another as the precipitation and temperature vary. Those factors cannot be predicted when preparing a pasture; therefore their choices are governed by the climatological data of the past years. The precipitation and temperature for the past ten years are given in figure II. The solid black line represents the mean monthly temperature. The dotted black line represents the mean annual temperature. The solid red line shows the monthly precipitation in inches. The dotted red line represents the annual precipitation. Each small square on the abscissa represents a month. Numbers on the right indicate inches and those on the left indicate degrees of temperature. A ten-year period is considered sufficient for the purposes of this paper.

Table III gives the grazing practices, how the pastures were stocked (opinions of stockmen and writer),

and the carrying capacity (now and should be) June 1941. The factors which aided in deciding what the carrying capacity should be are (1) the flesh of animals, (2) amount of supplemental forage being used, (3) kind, height, and density of pasture plants, (4) kind of soils and climatic conditions, (5) number and kinds of pests, and (6) competition of pasture plants. The order of the grazing practices is given in the table summary with the comparison of the degree of stocking in the writer's and in the stockmen's opinions. There were 1891 cow units being grazed which averaged one cow unit per 3.1 acres compared with 2249, the approximate number that could be grazed properly, or one cow unit per 2.8 acres. The native pastures decreased the cow units which could be grazed.

Information About Pastures Inspected. Pastures that were inspected were semi-prairie and prairie except pastures 7, 10, and 16 which were the lowland type. Number 7 is located in the heart of the Ft. Gibson bottoms. Pastures 10 and 16 are located near the Arkansas River. The carrying capacity of pasture 16 has been greatly reduced this year due to flooding of much of the pasture. On the fertile soil, sweet clover, Korean lespedeza, and rye grass were thriving, but the density in some areas was as low as 2 per cent. In pasture 7, Korean lespedeza and sweet clover were the major plants with Bermuda grass in small areas. This pasture was overstocked, thus requiring some supplemental feeding; however from all

indications the capacity was one cow unit per .7 acre. There were a few golden coreopsis (Coreopsis tinctoria).

Pasture 10 had a good mixture of sweet clover and Johnson grass (Sorghum halepense) in some areas, but the carrying capacity was greatly decreased by a large area which became covered with water after rains. Another hindrance to this pasture was the sandbur (Cenchrus pauciflorus). In some areas Bermuda grass was fast gaining on the other plants.

The owners differed in their reasons for raising cattle. Some depended upon their cattle mainly for a livelihood, others depended partially upon their cattle, and some raise cattle as a side line or hobby. This influences their adoption of desirable practices.

The pasture soils varied in individual pastures and from one pasture to another. The soils apparently were adapted to growing about the same kinds of plants.

In the semi-prairie and prairie pastures the carrying capacities varied from one cow unit per acre to one cow unit per 11.6 acres. Some of the factors that decreased carrying capacity were (1) areas occupied by timber, (2) noxious weeds, (3) low density of pasture plants, (4) gophers, and (5) ant hills.

Pastures 1, 2, 5, 13, 15, and 21 had an excess amount of timber for cattle shade. In most cases it would not require much time and labor to remove the timber; thus making the area a more valuable pasture.

The noxious weeds could be excluded from most areas of the pastures by mowing and discing. The most common noxious weeds are listed in figure 9. Those listed were observed in crossing pastures. Many other plants could be found if a botanist were to make a detailed survey, but these are the most conspicuous and common. Since the inspection of pastures was in June, other plants may be conspicuous at other seasons.

A few pastures were damaged by gophers. The greatest damage was in pasture 10 which had a forest on the north and east sides, and row crops on the south and west sides which made favorable habitats .

Ant hills were found in eight pastures. Pasture 23 was infested more than any other pasture studied. No vegetation was growing within a radius of four feet of the hills, and cattle were not grazing the vegetation growing near the inhabited ant hills. The stockmen are anxious to find some economical method of eradicating ants. Some have used gases but failed to get satisfactory results.

"Dairy animals seem to leave a greater ungrazed area about an ant hill than other animals," says W. T. Patterson, an elderly stockman, who lives about three and one-half miles east of Muskogee.

Stockmen desire to have good pastures, but time and expense of seeding often cause delay. It is desirable to have pasture plants that will reseed and make growth without being cultivated often.

Many pastures that were inspected could have had their

carrying capacities increased by having more plants growing per square foot and by eradicating pests. Some areas of pastures 9 and 15 had been cultivated in 1940 and opened to pasture in 1941 without sowing any seeds of pasture plants; therefore very little grazing was being obtained from these areas because the major growth was the common ragweed (Ambrosia elatior) and some crabgrass (Digitaria sanguinalis).

Muskogee County has many acres of pasture. It has been found that one acre of Bermuda grass produced 200 pounds of meat per year. Some unofficially claim to have produced 250 pounds of beef per acre of Bermuda grass in Muskogee County. When it and yellow hop clover are used as a pasture they have produced in eastern Oklahoma 300 pounds of meat per acre per year. The best native pastures produced not more than 70 pounds of meat per acre. ^{1/}

Korean lespedeza was producing much grazing. It makes a better pasture when about 20-25 pounds of seeds instead of the usual 15 pounds per acre are sown. A good demonstration of this may be seen in pasture 4. Korean lespedeza is a soil builder, drouth resister, a palatable legume, and a reseeder which makes it desirable wherever it may be grown. Korean lespedeza alone produced 150 pounds of beef per acre in northeastern Oklahoma. Grown with oats when both were pastured off, 200 pounds of meat per acre were

^{1/} Sam B. Durhan, Bermuda Grass, Mimeographed Circular Letter 9962, p. 2.

produced.^{2/} Korean lespedeza used with rye grass makes a splendid pasture. Nitrogenous fertilizers favor growth of grasses, and some grasses favor short grazing to long grazing, among them the blue grass.^{3/}

There is a condition in pasture 23 worthy of additional comment. During 1940 a favorable growth and a seed crop of Korean lespedeza were produced. During the fall of 1940, barley was sown and cultivated with a disc harrow. The lespedeza has excellent growth in some areas while in adjacent areas there are very few plants. The areas are very irregular. Apparently the soil is similar. The area had previously been terraced.

Rye grass meets the hearty approval of all stockmen who used it during 1940; however some were dissatisfied with rye grass in some past years. Some favored rye grass in cool moist falls, but disliked it during dry hot falls. Rye grass was found to be affording good grazing and producing an excellent crop of seeds where it was not overgrazed. It is highly palatable, seeds heavily, inhibits weed growth, and is an ideal protector of sown crops such as oats, wheat and barley.

Yellow hop clover is a favorite with all stockmen who have experienced its grazing value in Muskogee County during early spring. Only one of the stockmen in this study had sown yellow hop clover, and this he did through an error in

^{2/} Sam B. Durham, Korean Lespedeza, Mimeographed Circular Letter 03-15.

^{3/} C. M. Harrison, Plant Physiology, 6: pp. 669-84.

labeling of seeds. During 1935 small packages of yellow hop clover seeds were distributed over Muskogee County, and probably from these it has spread from pasture to pasture until almost every pasture contains some hop clover. It is the nature of the plant to grow in dense groups. To get the best results in seeding a pasture with hop clover, small areas should be sown very thickly near the droppings of the herds. These areas should be from 50 feet to 100 feet apart. The seeds from the plants are rapidly spread. Dry Decembers and Januarys will shorten the grazing unless there is an exceptionally favorable spring season. Only one of the past six years has been unfavorable for its growth in Oklahoma.^{4/}

Sudan grass makes an excellent pasture on fertile soil, but does not afford much grazing on poor soils. It is very palatable and favored by dairy animals over many other grasses. It is used as a supplemental pasture in many sections. There is a danger of prussic-acid poisoning from Sudan grass after a long drouthy season or following a frost. A four-year experiment of grazing showed that Sudan grass produced a greater daily gain than native buffalo or grama grasses.^{5/} There should be plants which add nitrogen to the soil used for Sudan grass in order to get the most grazing. An experiment showed that omission of nitrogen decreased the grazing 35 per cent the first year and 50 per

^{4/} Sam B. Durham, Yellow Hop Clover, Mimeographed Circular Letter 4619, pp. 2-3.

^{5/} E. E. Jacobs, Okla. (Panhandle) Agri. Exp. Sta. Bull. 35, pp. 8-12.

cent the second year.^{6/}

Sweet clover was suitable for grazing in the lowland pastures that contain lime and have a firm subsoil. Sweet clover should be kept closely grazed to get the greatest amount of grazing. It is desirable for dry seasons, since it has such deep feeding roots.

In the past with ample water supply stockmen have considered native pastures ideal, but as conditions have changed they no longer meet the needs of the stockmen. Cultivated pastures are taking the places of the native pastures because the production of livestock by-products is greater on cultivated pastures.

^{6/} D. S. Fink, G. B. Mortimer, and E. Troug, Journ. Amer. Soc. Agron. 25: pp. 441-52.

TABLE I
 INFORMATION ABOUT STOCKMEN, ANIMALS, AND PASTURES

Stockmen	Years*	Purebred Cattle	Grade Cattle	Cattle	Cattle Horses	Cattle Sheep	Acres of Native Pasture	Acres of Cultivated Pasture
<u>Less than 25 cow units</u>								
1. Levi Sexton	14		X		X		27	0
2. S. A. Sexton	5		X	X			100	10
3. Carl McCray	11		X	X			11½	8
4. G. R. Olds	20		X		X		15	9
5. Lyle Bell	30		X			X	75	0
6. A. L. Plunkett	30		X	X			39	25
7. Garland Phillips	8		X		X		0	10
8. Carl Mayer	10	X	X		X		0	90
<u>25-50 cow units inclusive</u>								
9. George H. Johnson	25		X		X		10	60
10. J. A. Baldwin, Jr.	2	X	X	X			0	55
11. S. E. Sherrill	20		X		X		25	35
12. E. E. Fretly	48	X	X		X	X	50	0
13. J. H. Gawf	45		X		X		25	50
14. I. B. Oldham	20	X			X		0	100
<u>51-100 cow units inclusive</u>								
15. L. D. Shirley	5		X		X	X	40	200
16. W. T. Patterson	15	X	X		X		0	175
17. J. K. Hogan	25		X		X		90	20
18. H. H. Rutherford	18		X		X		20	40
<u>101 or more cow units</u>								
19. A. J. Seward	20		X		X		0	340
20. George W. Seibald	20	X	X	X			300	20
21. M. R. McGahey	18		X		X		1900	150
22. Mrs. James Bradley	35		X		X		320	80
23. R. C. Borum	25	X	X		X		1500	1000
TOTAL		7	22	5	17	3	4447½	2477
<u>*Experience</u>								

TABLE II

BRUGGER'S OPINION OF BEST PASTURE PLANTS AND GREATEST HEDDS OF PASTURES

Pasture	Favorite Pasture Plants For:			Greatest Hedds
	Spring	Summer	Fall	
1	Hop clover	Bermuda grass	Bermuda grass	Wheat Common Ragweed Bitterweed
2	Winter oats	Sudan grass Lespedeza	Sudan grass Lespedeza	Barley None
3	Hop clover Rye grass	Bermuda grass	Bermuda grass	Wheat Blackberry
4	Rye grass	Bermuda grass Lespedeza	Bermuda grass	Common Ragweed Holes
5	Barley	Bermuda grass	Blue-stem Bermuda grass	Barley Cocklebur
6	Hop clover	Bermuda grass Sudan grass	Bermuda grass Sudan grass	Wheat Bitterweed
7	Sweet clover	Lespedeza	Lespedeza Sweet clover	Barley Wheat Holes Golden Carcopsis
8	Barley	Lespedeza Bermuda grass	Bermuda grass	Barley Wheat Turnips Holes Gophers
9	Rye grass	Lespedeza	Lespedeza Bermuda grass	Common Ragweed
10	Hop clover	Sweet clover Bermuda grass	Sweet clover Bermuda grass	Gophers
11	Wheat	Sudan grass	Oats	Bitterweed
12				Holes Common Ragweed
13	Rye grass Hop clover	Sudan grass	Oats Barley	Bitterweed
14	Rye grass	Bermuda grass Lespedeza	Lespedeza	Barley Bitterweed

-Continued-

TABLE II -CONTINUED-

15	Wheat	Cow peas	Cow peas	Wheat	Gophers Large-Bracted Wild Indigo
16	Oats	Lespedeza Sudan grass	Lespedeza	Wheat	Common Ragweed Ants
17	Hop clover	Sudan grass	Sudan grass	Wheat	none
18	Rye grass	Sudan grass Bermuda grass	Bermuda	Wheat	none
19	Hop clover				Cattle grub
20	Hop clover White clover	Sudan grass	Wheat	Wheat	Bitterweed
21	Rye grass	Lespedeza			none
22	Hop clover	Sudan grass	Sudan grass	Oats Wheat	Plantain
23	Barley Wheat	Bermuda grass	Bermuda grass	L. Blue- stem Blue grass	Gophers Ragweeds

Summary: Order of Preference:

9 Hop clover	10 Bermuda grass	10 Bermuda grass	11 Wheat	6 Common Ragweed
7 Rye grass	9 Sudan grass	5 Lespedeza	6 Barley	Bitterweed
Oats	8 Lespedeza	4 Sudan grass	4 Oats	4 Gophers
3 Barley	1 Sweet clover	2 Sweet clover	3 Rye grass	2 Ants
Wheat	1 Cow peas	Oats	1 Turnips	Cocklebur
1 Sweet clover		Wheat		Blackberry
White clover		Barley		Golden
		1 Cow peas		Coreopsis
		1 L. Blue-stem		Moles
				1 Cattle grub
				Plantain
				Large- bracted Indigo

Table III
 INFORMATION ABOUT PASTURES

Grazing Practices	How Stocked		Carrying	
	Owner's Opinion	Writer's Opinion	Now	Should Be
*				
1 Continued	Under	Properly	9	9
2 Deferred	Under	Under	14	20
3 Supplemental	Over	Over	16	10
4 Deferred	Under	Properly	19	19
5 Continued	Under	Under	20	25
6 Deferred	Under	Under	19	30
7 Supplemental	Over	Over	52	15
8 Deferred	Under	Under	23	50
9 Supplemental	Over	Over	25	20
10 Continued	Properly	Properly	30	30
11 Deferred	Under	Properly	31	31
12 Continued	Under	Under	33	40
13 Deferred	Properly	Properly	37	37
14 Deferred	Properly	Properly	48	48
15 Deferred	Under	Properly	54	54
16 Supplemental	Over	Over	59	50
17 Supplemental	Properly	**	69	
18 Supplemental	Over	Over	84	60
19 Deferred	Properly	Properly	110	110
20 Deferred	Properly	Over	130	100
21 Deferred	Properly	Under	177	300
22 Deferred	Properly	Properly	191	191
23 Deferred	Under	Under	670	1000
		Totals	1891	2249

Summary: Order of Data:***

13 Deferred	10 Under	9 Properly
6 Supplemental	8 Properly	7 Under
4 Continued	5 Over	6 Over

* The numbers are pastures as used in table I

** The writer did not inspect No. 17; therefore it was left blank in two columns.

***Preceding numbers in each case indicate the number of pastures of that type listed in the table.

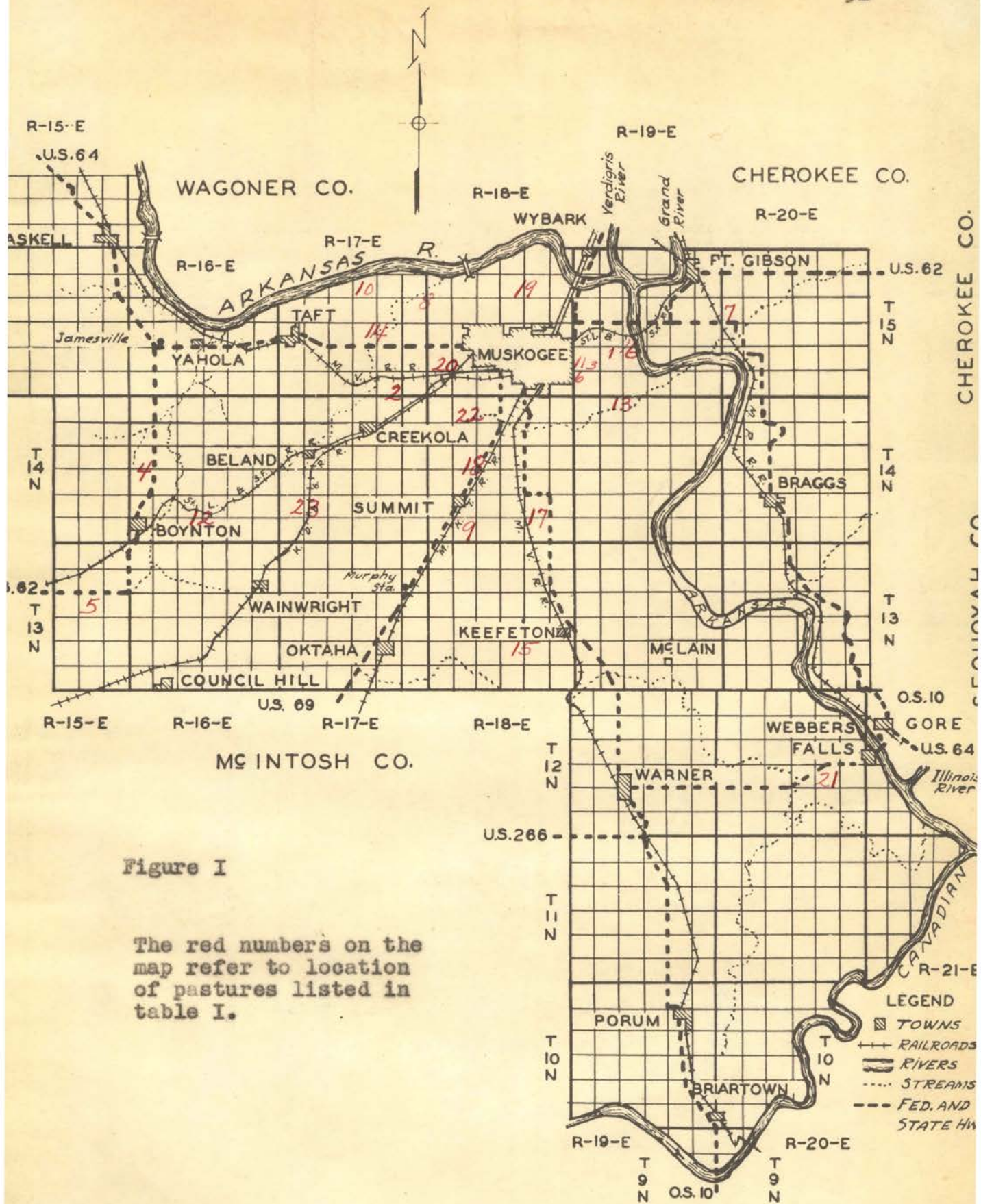


Figure I

The red numbers on the map refer to location of pastures listed in table I.

MUSKOGEE COUNTY

OKLAHOMA

Clonts-Morgan Engineering Co
Muskogee Oklahoma.

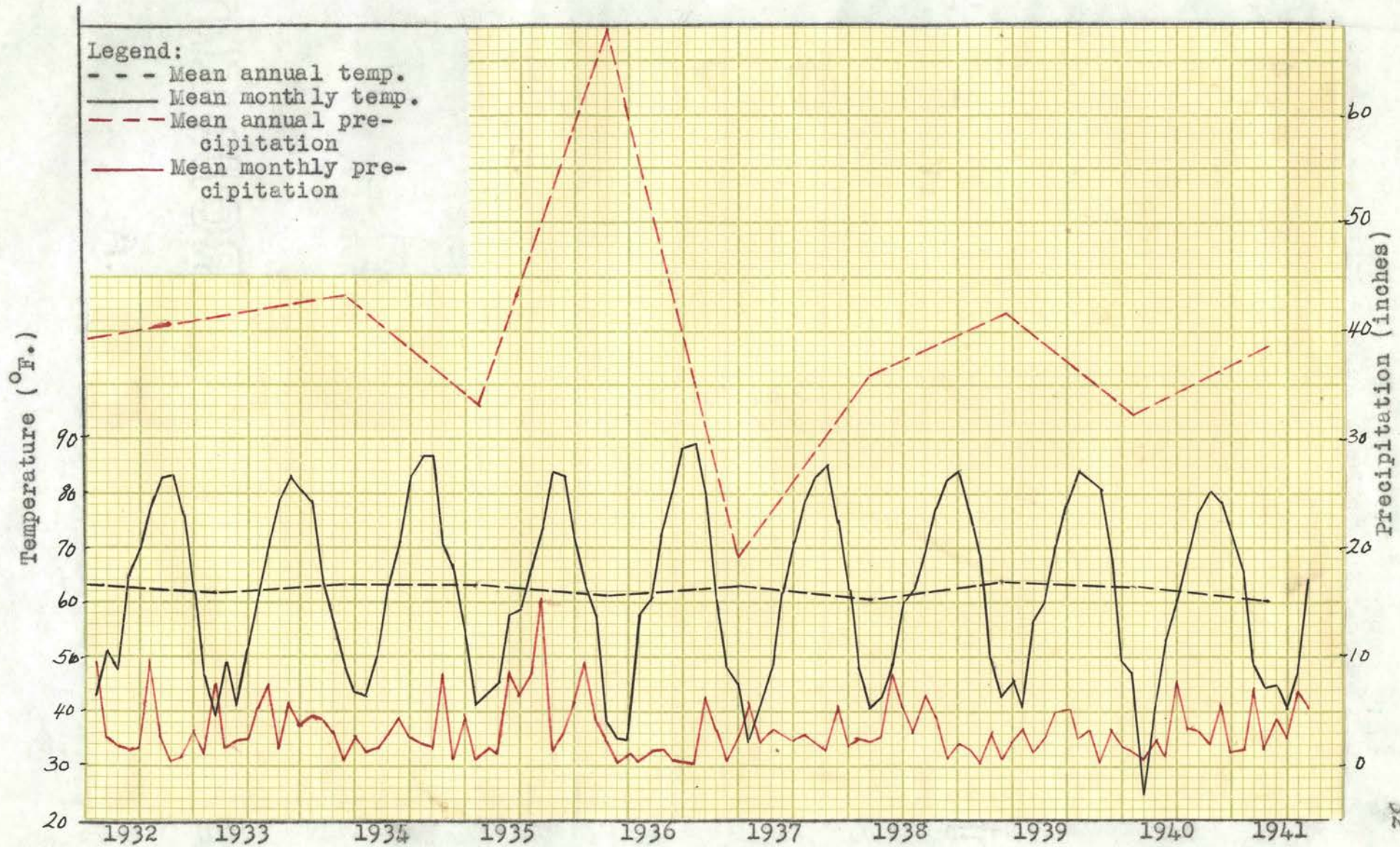


FIGURE II TEMPERATURE AND PRECIPITATION OF MUSKOGEE CO. FOR 1932-41



Figure 3



Figure 4

Figure 3 illustrates pasture 15 which has been overgrazed previous to this year. The daisies in the foreground are 18 inches high. The larger weeds in the picture are large-bracted Wild Indigo (*Baptisia bracteata*). The carrying capacity has been decreased approximately 25 per cent by these weeds.

In figure 4 is shown a grass area in an opening of a timbered section. The hat is on a stake 30 inches high and the growth preceding the trees is composed largely of blackberry briars.



Figure 5



Figure 6

Figure 5 shows an ant hill with a denuded area of 6 feet radius. The area within 3 feet of the denuded area had not been grazed.

Figure 6 shows another part of the same pasture (23) as in figure 5.

Both parts were sodded with Bermuda grass at the same time and had received similar care. The area in figure 5 has been mowed to eradicate weeds and that in figure 6 has been disced. They were both being grazed by the same herd. The hat, 5 1/4 inches high, indicates the height of the grass.

STRATFORD PARKING

100% RAG U.S.A.



Figure 7



Figure 8

Figure 7 shows erosion by water which is decreasing the grazing area and causing leaching over a greater area. This is a scene in pasture 15.

Figure 8 is a scene taken in pasture 21 which was understocked. Much food will be stored in the roots of the plants and viable seeds will be produced. The major portion of grass in the picture is Little Blue-stem (Andropogon scoparius).

FIGURE IX. A LIST OF NOXIOUS PLANTS FOUND IN PASTURES

- Common Ragweed (*Ambrosia elatior*)
Bitterweed (*Actinea linearifolia*)
Narrow-leaved Plantain (*Plantago purshii*)
 or
Purch's Plantain
Dog-Fennel (*Anthemis cotula*)
Large-bracted Wild Indigo (*Baptisia bracteata*)
Sandbur (*Cenchrus pauciflorus*)
Golden Coreopsis (*Coreopsis tinctoria*)
Nightshade (*Solanum carolinense*)
 or
Horse-Nettle
Daisy Fleabone (*Erigeron annuus*)
Black-eyed Susan (*Rudbeckia hirta*)
Buttonweed (*Diodia teres*)
Smartweed (*Polygonum hydropiper*)
Common Yarrow (*Achillea millefolium*)
Indian Paint Brush (*Castilleja coccinea*)
Ironweed (*Vernonia baldwinii*)
Peppergrass (*Lepidium teranum*)
Narrow-leaved Dock (*Rumex altissimus*)
Cocklebur (*Xanthium canadense*)
Blackberry (*Rubus villosus*)
Purple Star Thistle (*Centaurea calcitrapa*)
Sneezewort (*Achillea ptarmica*)
Trumpet Creeper (*Tecoma radicans*)
Milkweed (*Asclepias speciosa*)

Chapter V

CONCLUSIONS AND RECOMMENDATIONS

Some stockmen were overgrazing their pastures and permitting noxious weeds to grow. Stockmen consider a pasture an essential source of income in a well-balanced program, yet a number were not using their pastures in such a way as to serve maximum returns.

A trend since statehood has been toward smaller areas controlled by individuals. The breeds of cattle are replacing the grade types.

Native pastures are being replaced by cultivated pastures, due to the increase in grazing. With the government agencies such as the Civilian Conservation Corps to aid in terracing and sodding, better pastures are being provided. Information may be obtained from county agents on the provisions and allowances made to stockmen for such work.

Conclusions. Too few stockmen secure optimum amount of grazing from the acres under their supervision. This is due largely to negligence and allowing the carrying capacity to be decreased by scrubby timber, barren areas, noxious weeds, and ant hills in the pastures.

Of the twenty-three pastures studied, the carrying capacity averaged 3.1 acres per cow unit according to data in questionnaires. The writer estimates the carrying capacity of 22 of these pastures to be 2.5 acres per cow unit. Carrying capacities varied from .7 acre per cow unit in pasture 7 to 11.6 acres per cow unit in pasture 21. (See figure 8, page 35).

The most reliable winter pasture is wheat when sown with rye grass and yellow hop clover which affords the best spring grazing. During summer and fall the best pasture combination is Bermuda grass and Korean lespedeza. An excellent supplemental pasture for late spring, summer, and early fall is Sudan grass, especially for dairy herds. Sweet clover is adapted to lowlands, and it provides splendid grazing when kept grazed closely. More Korean lespedeza, sweet clover, and yellow hop clover should be grown in Muskogee County to aid in soil building.

When Bermuda grass is used as a pasture, it should be disced or cultivated at least every two years to secure more grazing and to prevent run-off. It is advisable to use rye grass if the fall is cool with adequate rainfall, but very poor stands may be expected if it is sown during a hot fall.

Recommendations to Stockmen. The writer recommends that stockmen form small community organizations to sponsor worthwhile activities, such as securing purebred sires to be used by any member. This would enable the small owner to improve his herd without too much expense. Better sires could be provided with less cost to an individual. In large herds there could be an exchange of sires, thus preventing inbreeding.

There should be regular meetings and meeting place with a well-planned program. Specialists could be called in to present recent developments and findings on pastures. An excellent program would call for a well-directed round-table discussion which presents the real problems and leads

to an exchange of ideas.

The organization could sponsor grazing experiments for the different seasons and with different combinations of plants. From these experiments all participants would receive valuable information. Such an undertaking would make stockmen more observant, and would extend the pasture data available to each workman.

Those with inadequate ponds should take advantage of the government allowance, up to fifty dollars, in building additional ponds. The details may be secured at the county treasurer's office.

For permanent pastures, deferred grazing is the best practice. A sufficient amount of seeds of pasture plants must mature to reseed the area from which plants were excluded. The most suitable plants for cultivated pastures for spring grazing are yellow hop clover, rye grass, and oats; for summer and fall, Korean lespedeza, Bermuda grass and Sudan grass; and for winter, wheat, barley, rye grass, and oats.

Last, but not least important, every stockman should keep an accurate livestock and pasture record to rely upon rather than depending on memory.

Suggestions for Further Study. Unlimited studies related to this one might be made. The following are suggested: Methods of eradicating noxious weeds in native pastures, an economical method of destroying ants, and discing versus mowing to destroy weeds in a Bermuda grass pasture.

Pasture 23 is an example of two years' results that would aid in studying this last question.

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